FSK3370 Optics of the Human Eye 7.5 credits

Ögats optik

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

Course syllabus for FSK3370 valid from Spring 2019

Grading scale

P, F

Education cycle

Third cycle

Specific prerequisites

Recommended previous knowledge: Geometrical optics

The student should have been accepted as a research student.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

The overall goal of this course is to give the student an understanding of the optical properties and function of the human eye.

After completing this course, the student should be able to

- Describe the function of the optical components of the eye
- Calculate the position and size of the image in the reduced schematic eye
- Apply geometrical optics methods to calculate the size of the blurred retinal image due to refractive errors as well as to calculate the effect of different optical corrections
- Compare different subjective and objective techniques to measure the optical errors of the eye
- Evaluate the image quality in different schematic eyes with simple software for optical design (such as WinLens)
- Analyze the retinal image quality (in the form of PSF and MTF) from a wavefront measurement with existing MatLab-routines
- Rank the effects on image quality and vision of different monochromatic and chromatic aberrations as well as of scattering
- Describe the light sensitivity of the retina, both with regard to the wavelength and the direction (the Stiles-Crawford effect) of the light, additionally, reflect on how this will influence vision for an eye with scattering and aberrations
- Describe age related changes in the optics of the eye, with emphasize on the origin and possible compensation of presbyopia

Course contents

Fundamental knowledge on the optical components of the human eye and how these form the image on the retina. Different schematic eyes as well as the different axes of the eye. Paraxial image formation in the eye and the effect of refractive errors as well as their correction. Passage of light in the eye: photometric quantities, light sensitivity of the retina, scattering, the Stiles-Crawford effect. Subjective and objective techniques to measure the optical errors of the eye, both regarding refractive errors, monochromatic and chromatic aberrations. Evaluation of the image quality on the retina with PSF and OTF. Effect of optical errors on image quality as well as on vision. Age related changes in the eye, accommodation, presbyopia, and depth-of-field.

Disposition

The students read the course literature and prepare presentations and assignments individually. All students and the examiner then meet for the oral presentations.

Course literature

”David A. Atchison & George Smith, "Optics of the human eye," Butterworth-Heinemann, 2000. In addition, relevant course literature can be added by the participants, e.g., help manuals for WinLens and MatLab."

Examination

- INL1 - Assignment, 7.5 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

Other requirements for final grade

Oral presentation of the course literature, construction and correction of assignments to the other course participants, as well as solving their assignments.(P/F)

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.